

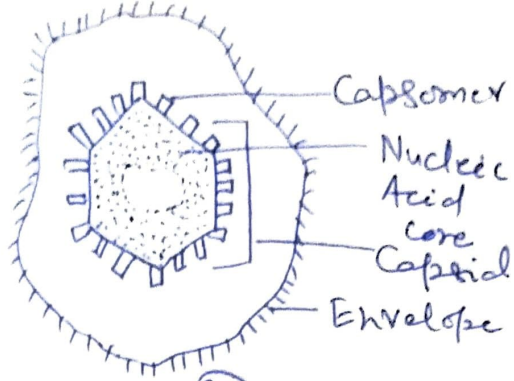
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D III Hons Paper - VI Page - 1
Group A - Medical Biology.
Lecture - 1.
PATHOGENIC MICROBES
VIRUSES

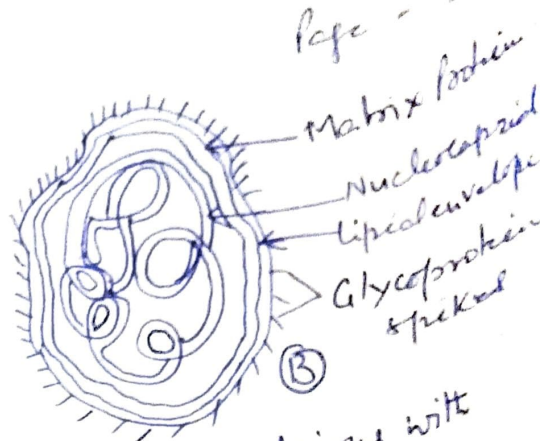
Introduction :- Viruses are known as link between the living and non-living world. Until 19th century, harmful agents or organisms were grouped together & were sometimes referred to as viruses. (Latin. virus - poison or venom) Undoubtedly, viruses are harmful entities that are known to cause several diseases in man, animals and plants. Branch of biology dealing with viruses and viral diseases is known as virology. Viruses are an infectious agent with a simple acellular organization with a protein coat and a single type of nucleic acid i.e. either DNA or RNA, lacking independent metabolism and capable of reproducing only within living host cells. The protein coat surrounding a viral genome (RNA or DNA) is called capsid. Capsid may further be surrounded by a lipid membrane (envelope). A complete virus particle that represents the extracellular phase of a viral cycle is known as a virion.

General Properties of viruses :- These are a unique group of infectious agents, distinct from other living forms in having simple form, acellular organization and different pattern of replication.

- ① A complete virus particle or virion consists of one or more molecules of nucleic acid (DNA or RNA) enclosed in a protein coat. Sometimes surrounded by other layers. The other layers may be complex & consists of carbohydrate, lipids and proteins.



① Enveloped virus with icosahedral symmetry



② Enveloped virus with helical symmetry.

- ② viruses exist in 2 phases (a) Extracellular (nonliving) and (b) intracellular (living).
- ③ Virions, the extracellular phase possess only a few enzymes (if present). Virions cannot replicate and they can be crystallized.
- ④ In their intracellular phase viruses exist as replicating nucleic acids, which induces host metabolism to synthesize virion components, eventually complete virus particles are released.

Viral Morphology

The morphology of viruses has been studied intensely over the past century, because of their importance as pathogens and reality is that viruses have simple structure.

Size:- Size of a virion ranges from 10 - 300 or 400 nm in diameter. The smallest viruses are a little larger than ribosomes. While the pox virus is like vaccinia can be observed easily under a light microscope. Most viruses are too small to be viewed under light microscope.

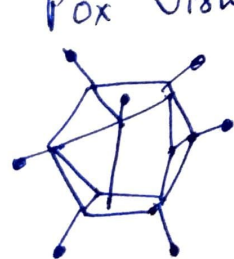
Structure:- All virions are constructed around a nucleocapsid core. The nucleocapsid is made up of a nucleic acid either DNA or RNA enclosed within a protein coat called the capsid. Capsid protects the viral genome & aids in its transfer between host cells. Four types of capsids & virion structure.

① Cubical (Icosahedral) capsids :- An Icosahedron is a regular polygon with 20 equilateral triangular faces with 12 vertices. When viewed at low power in an electron microscope these viruses appear spherical. EX - Adenovirus, Polyoma virus, Picornavirus & ϕ X174 phage etc.

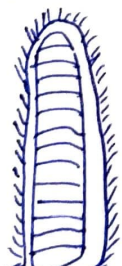
② Helical capsid :- These are shaped like hollow protein cylinders. In these viruses capsomeres & nucleic acids are wound together forming a hollow or spiral tube. These are RNA viruses. EX - Tubulovirus, TMV etc.

③ Enveloped virus :- In many viruses the nucleocapsid is surrounded by an outer membranous layer. These are roughly spherical, though their nucleocapsid can either be icosahedral or helical. The animal virus envelopes usually arise from host cell plasma or nuclear membrane. The lipid & carbohydrate component of the envelope is made by normal host constituents. Spikes or peplomers present on envelope surface. EX - Influenza virus, Paramyxovirus, Herpes virus etc.

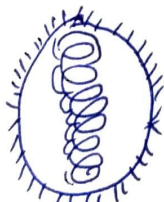
④ Complex virus :- The capsid symmetry of these viruses is neither purely icosahedral nor helical. These viruses may possess tail & other structures. EX - Bacteriophages, Pox viruses such as Vaccinia.



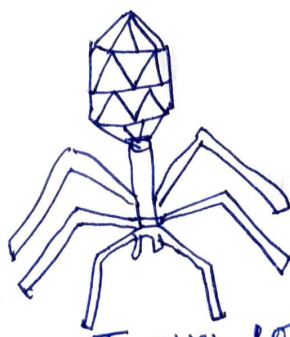
Adenovirus.



Rabdo virus



Influenza virus



T-even coliphage



Flexuous tailed virus

Structure of virus.

Shape :- Shape of viruses varies in different groups. Most of animal viruses are roughly spherical. Rabdo virus is bullet shaped. TMV is rod shaped. Some viruses are irregular & pleomorphic in shape.

Chemical Properties :-

- ① Nucleic Acid :- Viruses contain only one type of nucleic acid. The viral genome is made up of either single or double stranded DNA or RNA. This extracted viral nucleic acid is capable of initiating infection, when introduced to a host cell. No. of genes carried by a virion varies from 4-8 in smaller viruses & 100-200 for larger ones.
- ② Viral Proteins & Lipids :- The capsid & lipid envelope of viruses determine their antigenic specificity.
- ③ Resistance :-
 - (a) Temperature :- Most of the viruses are heat labile & are inactivated at 56°C for 30 mins & 100°C for a few seconds.
 - (b) Cold :- Viruses are stable in cold condition, they can be crystallized & stored indefinitely at -40°C to -70°C by lyophilization or freeze drying.
 - (c) Radiation :- Viruses are inactivated by UV radiation & ionizing radiation (X-Rays, Gamma Rays). UV rays dimerize the pyrimidine bases of nucleic acid which the ionizing radiation cause lethal breaks in genome.
 - (d) Lipid Solvents :- All viruses with lipid protein envelope are destroyed by ether, chloroform & bile salts.
- ④ Disinfectants :- Oxidizing agents such as chlorine, iodine, and hydrogen peroxide are able to destroy most of the viruses. ~~Almost~~ ~~not~~ Most of the viruses are resistant to phenol & enteroviruses or hepatitis viruses are not always inactivated by chlorination, particularly if present with organic or faecal material.

To be continued